

II. THE OPTIONAL OBSERVATIONS

28. The Conference recommends the following observations and inquiries to the notice of all gentlemen who have either to draw up instructions for an expedition, or themselves to take part in one.

29. Meteorology. The variation of temperature with height; the temperature of the soil, the snow, and the ice on the surface and at various depths; solar radiation; evaporation at all seasons. The melting of ice in the summer.

30. Terrestrial magnetism. Occasional absolutely simultaneous readings of all three magnetical instruments, so as to determine accurately the relation between the simultaneous variations of horizontal and vertical intensity.

31. Galvanic earth currents. Observations of earth-currents in close connection with magnetic observations and those of auroral phenomena.

32. Hydrographical observations. Observations on currents, on the thickness, structure, and motion of ice, soundings and observations on the physical properties of sea-water, e.g. determinations of its temperature and specific gravity. Tidal observations if possible by means of automatic apparatus.

33. Aurora. Measurements of the height of the aurora by two observers stationed about 5 kilometres (3 miles) apart in the line of the magnetic meridian—spectroscopic observations.

34. Observations on atmospheric electricity; on astronomical and terrestrial refraction; on twilight; on the length of the second's pendulum; on the growth and structure of floating ice and of glaciers. The collection of samples of air for analysis.—Observations and collections in the departments of zoology, botany, geology, &c.

III. THE REDUCTIONS AND CALCULATIONS AT THE PLACE OF OBSERVATION

35. The rules adopted by the Congresses of Vienna and Rome are to be followed in all calculations and reductions of meteorological observations.

36. As regards the discussions of magnetic observations the adoption of the metrical units of Gauss is recommended. From the variation observations, the declination, and the horizontal and vertical components of the intensity are to be deduced.

IV.—PUBLICATION OF THE OBSERVATIONS

37. Summaries of the observations are to be sent to the International Polar Commission, as soon as possible after the return of the expedition, so as to be published speedily and in a uniform manner. It is desirable, if possible, to send even earlier notices of the fate and general progress of the expedition.

38. All observations are to be published *in extenso* when their discussion is complete. The International Polar Commission will therefore be reassembled for a fresh Conference, to learn the amount of information which has been obtained, and to come to an agreement as to the best mode of its publication.

39. In this publication the Metric scale will be used, and all temperatures expressed on the centigrade scale.

Nothing could be more complete and satisfactory than this programme, and from the results when reduced and carefully compared, valuable data may be expected as to the physics of the Arctic regions. We trust nothing will occur to mar the success and continuity of the observations, and that they will be such as to encourage their continuance, for we fear that a single year's observations cannot be regarded as furnishing anything like sufficient data to warrant perfectly trustworthy conclusions. The Commission very wisely decided that it would be advisable to obtain series of observations at existing observatories outside the Arctic Area, but as far as possible in the northern hemisphere. To their Circular on this subject they have received favourable answers from the following astronomical and meteorological observatories:—Pola, Munich, Utrecht, Moncalieri, Helsingfors, Breslau, Cordoba (South America), Potsdam, Naples, Lisbon, and Stonyhurst.

At the last moment, the English Government, although they sent no delegate to the Congresses, have decided, we are glad to say, to take a share in the great international undertaking. The following then is a list of the stations,

beginning at Behring Strait, and coming eastwards, with the countries whose parties are to occupy them:—

Point Barrow, N.W. Coast Alaska. $71^{\circ} 18' N.$, $156^{\circ} 24' W.$
United States.

Fort Rae, Great Slave Lake. $62^{\circ} 30' N.$, $115^{\circ} 40' W.$ England
and Canada.

Cumberland Sound, Davis Strait. $66^{\circ} 30' N.$, $66^{\circ} W.$ Germany.
Lady Franklin Bay, N.E. Coast Grinnell Land. $81^{\circ} 20' N.$,
 $64^{\circ} 58' W.$ United States.

Godthaab, W. Coast of Greenland. $64^{\circ} 10' N.$, $51^{\circ} 45' E.$
Denmark.

Jan Mayen Island, between Greenland and Norway. $70^{\circ} 58' N.$,
 $8^{\circ} 35' W.$ Austria.

Spitzbergen. $79^{\circ} 53' N.$, $16^{\circ} E.$ Sweden.

Bossekop, N. Coast Norway. $69^{\circ} 56' N.$, $23^{\circ} E.$ Norway.

Sodankylä, N. Finland. $67^{\circ} 24' N.$, $26^{\circ} 30' E.$ Finland.

Novaya Zemlya, Karmakulé Bay. $72^{\circ} 30' N.$, $53^{\circ} E.$ Russia.
Dickson's Harbour, Mouth of Jenissei. $73^{\circ} 30' N.$, $82^{\circ} E.$
Holland.

Mouth of Lena. $73^{\circ} N.$, $124^{\circ} 40' E.$ Russia.

Besides these France will carry on observations at Cape Horn, and Germany at South Georgia, on the borders of the Antarctic area; while, on behalf of Italy, Lieut. Bové is co-operating in the Italian Antarctic Expedition.

THE LAY OF THE LAST VORTEX-ATOM

(Vide "THE UNSEEN UNIVERSE")

Melody—*Lorelei*

THE Vortex-Atom was dying

The last of his shivering race—

With lessening energy flying

Through the vanishing realms of Space.

No more could he measure his fleeting—

No milestones to mark out his way;

But he knew by his evident heating

His motion was prone to decay.

So he stayed in his drift rectilinear

For Time had nigh ceased to exist,

And his motion grew ever less spinnier

Till he scattered in infinite mist.

But as his last knot was dissolving

Into the absolute nought—

"No more," so sighed he resolving,

"Shall I as atom be caught.

"I've capered and whirled for ages,

"I've danced to the music of spheres,

"I've puzzled the brains of the sages—

"Whose lives were but reckoned by years.

"They thought that my days were unending,

"But sadly mistaken were they;

"For, alas! my 'life-force' is expending

"In asymptotic decay!"

Edinburgh University

K.

OUR HEALTH RESORTS¹

The Scottish Highlands

THE Highlands of Scotland have been rapidly rising in importance during recent years, as affording during the summer and autumn months the most desirable health resorts to professional and business men, as well as to invalids: the most varied scenery, unique as it is picturesque, to the tourist; and the most attractive pleasure-grounds to the sportsman. When it is considered how comparatively unknown to the general run of summer tourists and visitors are the climatic and scenic attractions of large portions of the Highlands, and how

¹ See vol. xxv. p. 155.

rapidly the means of transit is being developed, and of accommodation multiplied, it is evident that for some years to come this popularity will continue to grow. These great advantages and attractiveness are due to physical configuration and climate.

As regards climate, the two points to be specially considered are the rainfall and temperature. Of these the most varied, and apparently the most capricious, is the rainfall, which alone imparts to the Highlands very great diversity in its climates.

An annual rainfall of forty inches may be taken as the limit separating the dry climates of the East from the wet climates of the West Highlands. If a line be drawn from Perth to Cape Wrath, all parts of Scotland to the east of it have, roughly speaking, a rainfall not exceeding forty inches, whereas to westward of that line the annual rainfall exceeds that amount. Hence the Eastern Grampians, the Highlands between the Don and Moray Firth, and the Highlands of Eastern Perth, Eastern Inverness, Eastern Ross, Eastern Sutherland, and Caithness are characterised by climates which are comparatively dry, and therefore bracing.

A glance at the map will show that the whole of the Scottish Highlands is, with respect to the west-south-west winds, entirely unprotected by Ireland, and completely exposed to these vapour-laden winds of the Atlantic. Over the whole of Scotland to the south of the Forth and Clyde, which may be regarded as under the lee of Ireland, the average rainfall at no station exceeds 66 inches, with the single exception of Ettrick Pen Top, 2268 feet high, at which fourteen years' observations gave an annual average of 71 inches.

On the other hand, the Highlands to the north of the Clyde are fully open to the west-south-west winds of the Atlantic, and there accordingly the late summer and autumnal rains set in early and with great copiousness. Over an extensive tract resting, as it were, on a base line stretching from Dunoon to Balquhidder, and extending north-westward to beyond Dunvegan, in Skye, the annual rainfall is at least 80 inches. In this extensive region the heaviest rainfalls, and therefore wettest climates are met with in situations either inclosed among mountains of rugged grandeur, such as the districts about Lochs Coruisk, Hourn, and Shiel, or up and over such plateaux as that whence rise the Tay, Leven, Orchy, Aray, and Falloch. The spot of largest rainfall in Scotland, so far as known, is near the head of Glencoe, situated between Lochs Fyne and Long, the mean annual amount there being 128 inches. Surrounding in a somewhat irregular manner this wet district, and stretching northward along the watershed, as far as Loch Assynt, is another region of twice the extent over which the rainfall is from 60 to 80 inches. Again, on the east of this region, and between it and the line marking an annual rainfall of 40 inches, is an extensive tract stretching as far as Cape Wrath, which has a rainfall from 40 to 60 inches annually, and the same rainfall is found in Western Sutherland, a large portion of Western Ross, the whole of the Hebrides, and all islands to the south, the surfaces of which rise to no great height above the sea.

Reference has been made to the shelter afforded by Ireland in imparting a drier climate to places situated to the east-north-east of it. The same principle is seen in the influence of Skye and the Hebrides in bringing about the comparatively dry climate of Western Ross and Sutherland, the rainfall of which is from 15 to 20 inches less annually than in similar situations south of Skye, but unprotected from the rain-bringing winds of the Atlantic. Indeed of all places in the west situated to the north of the Crinan Canal, Western Ross and Sutherland enjoy the driest, most bracing, and most desirable climates.

This district has besides an additional advantage, which it possesses along with Skye and Western Inverness-shire during the prevalence of rain-bringing winds

from the east. In the east of Scotland the heaviest rains are brought by winds from the east, which are not unfrequently accompanied with a downfall of 2 or 3 inches, or even on rare occasions of 4 inches of rain in a day. The worst and most persistent of these winds, which cause, perhaps, the most disagreeable weather of these climates, owing to the mixture of cold drizzle and rain they bring with them, seldom deposit any rain over the west coast to the north of the Crinan Canal, and over the west of Perthshire. Indeed, on such occasions the weather in the west is almost always marvellously fine, and once enjoyed can never be forgotten, skies of the utmost purity, beauty, and softness, a brilliancy and warmth in the sunshine, a deliciousness in the air, and lights, colouring, and shades towards evening, of such infinite variety and beauty as perhaps no other climate can match.

As regards temperature, the great attraction of the climate of the Scottish Highlands is its comparative coolness, and this coolness becomes, of course, all the greater, the higher we ascend above the sea. As compared with London, the summer temperature of Braemar, for example, during the months of July, August, September, and October, is respectively $8^{\circ}9$, $9^{\circ}0$, $9^{\circ}1$, and $7^{\circ}4$ lower. The evenings and the nights are proportionally colder than the days. This is the climate which is best adapted for active exercise on the hills and moors. The admirably bracing and other hygienic qualities of the air of places which have comparatively dry climates, and which are 700 feet and upwards above the sea, are everywhere recognised; and it is these qualities which give the upper districts of Deeside, Donside, and Speyside the finest summer climates anywhere to be found in the British islands, particularly for those whose systems require to be braced up for the work of the coming winter. No other district, at these heights and temperatures, which contribute so important an ingredient to the climatic conditions required, can be named, having at the same time accommodation necessary for the comfort of summer visitors, which has not a summer climate essentially wet. The climates of places 700 feet high and upwards in Wales, the Lake District, on the slopes of the Lead and Lowther Hills, and eminently the West Highlands, can only be described as wet in comparison with those of the upper districts of the Dee, Don, and Spey.

Many excellent summer climates, but of quite a different type, are to be found at somewhat lower levels. Among the best of these, omitting sea-side climates, may be named Pitlochrie, Blair Athol, Lairg, Banchory, Dunkeld, Crieff, and Inverleithen, together with Callander and Moffat, the last two, however, being decidedly wetter. The important point to be attended to in selecting summer quarters in the Scottish Highlands is the rainfall, which is really the element of weather on which differences of climate depend; and attention to this point is all the more necessary, since in not a few cases a dry climate and a wet climate are to be found at comparatively short distances from each other.

ON "GETTING" COAL BY MEANS OF CAUSTIC LIME

THE operation of "getting" or breaking down coal from its original position in a seam cannot, in some cases, be effected with a sufficient degree of economy without the aid of blasting. But a certain amount of risk always attends the use of explosive substances, when they are employed for this purpose in fiery mines which are at the same time dry and dusty, unless certain precautions are taken which do not yet appear to be either generally observed or enforced by law. The existence of this danger has long been known, although its causes are only now beginning to be understood; and inventors have